AMENDMENTS TO THE CLAIMS

Claim 1 (currently amended): A method of enhancing detection for a specific object or distribution thereof in a body, comprising the steps of:

(a) administering to said body for detection of the object, if present, a nanoparticulate, the nanoparticulate having the following properties:

i. it is at least partially metallic,

ii. it has a formed non-spherical shape having a minimal characteristic dimension in the range from about 1 to about 3000 nanometers, and

iii. it has a formed composition capable of producing thermal pressure either in said nanoparticulate or in said object greater than said object could produce as a result of step (b) in the absence of said nanoparticulate; ~~and~~

(b) directing onto said body specific electromagnetic radiation having a wavelength or spectrum of wavelengths in the range from ~~300~~ 3 nm to 300 mm selected so that the wavelength or wavelength spectrum is longer by a factor of at least 3 than the minimum characteristic dimension of said nanoparticulate, said nanoparticulate absorbing said electromagnetic radiation more than would one or more non-aggregated spherically shaped particles of the same total volume with a composition identical to said nanoparticulate, said nanoparticulate by such absorption producing an enhanced optoacoustic signal resulting from said absorption;

(c) receiving said optoacoustic signal;

(d) converting said received optoacoustic signal into an electronic signal characterized by at least one parameter selected from amplitude, frequency, phase, temporal profile, time of arrival, frequency spectrum, or a combination of any one or more of such parameters; and

(e) presenting said signal for assessment of said at least one parameter by a human or a machine.

Claims 2-4 (canceled).

Claim 5 (original): The method of claim 1 in which interaction of said nanoparticulate with said object produces a shift of the absorption maximum by said nanoparticulate for said selected wavelength or range of wavelengths.

Claim 6 (original): The method of claim 1 in which said nanoparticulate is a collection of nanoparticles characterized in having a most probable size and a most probable absorption maximum at a selected wavelength or range of wavelengths.

Claim 7 (original): The method of claim 6 in which said collection of nanoparticles has a most probable aspect ratio of from about 2 to about 10.

Claim 8 (original): The method of claim 6 in which the longest dimension of said most probable nanoparticles is in the range from about 2 nanometers to about 200 nanometers.

Claim 9 (original): The method of claim 5 in which said nanoparticles have a plurality of size distribution modes.

Claim 10 (original): The method of claim 6 in which said nanoparticles are combinations of nanoparticles of one shape with nanoparticles of another shape to form geometries capable of absorbing a selected specific wavelength or range of wavelengths.

Claim 11 (original): The method of claim 1 in which said nanoparticulate comprises a nanoparticle aggregate.

Claim 12 (original): The method of claim 11 in which aggregate includes spherical nanoparticles.

Claim 13 (currently amended): The method of claim 11 in which said aggregate is ordered and in which said nanoparticles are at least partially coated with a targeting vector comprising organic material[[,]] ~~such organic material comprising genetic material~~.

Claim 14 (original): The method of claim 6 in which said metal of said collection of at least partially metallic nanoparticles is selected from gold, silver, platinum, a form of carbon having metallic properties, a mixture of at least two of said metals, or an alloy of at least two of said metals.

Claim 15 (original): The method of claim 6 in which said collection of nanoparticles has a most probable size of less than 1000 nanometers.

Claim 16 (original): The method of claim 6 in which said collection of nanoparticles has a most probable size of less than 300 nanometers.

Claim 17 (canceled).

Claim 18 (original): The method of claim 6 in which said nanoparticles are solid.

Claim 19 (original): The method of claim 6 in which said nanoparticles comprise shells having a negative value of the real part of the complex dielectric permeability.

Claim 20 (original): The method of claim 19 in which said shells have a dielectric core.

Claim 21 (original): The method of claim 19 in which said nanoparticles have a core with a negative value of the real part of the complex dielectric permeability.

Claim 22 (original): The method of claim 19 in which the shells are filled with a substance having a coefficient of thermal expansion in the range of 9.times.10.sup.-2 mm.sup.3/joule to 2.times.10.sup.3 nm .sup.3/joule.

Claim 23 (original): The method of claim 22 in which said substance is selected from the group comprising water, aqueous gels, hydrogels, gases, lipids and other organic substances.

Claim 24 (original): The method of claim 6 in which said nanoparticles are at least partially coated with one or more organic materials.

Claim 25 (original): The method of claim 24 in which said nanoparticles are at least partially coated with one or more biological materials.

Claim 26 (original): The method of claim 24 in which said organic material is bound to the surface of the nanoparticles physically or chemically or both.

Claim 27 (original): The method of claim 24 in which said organic material is ambiphilic.

Claim 28 (currently amended): The method of claim 24 in which said organic material comprises ~~block copolymers in which one block is~~ polyethylene glycol or a derivative thereof.

Claim 29 (original): The method of claim 24 in which said organic material includes reactive functional groups, including hydroxyl groups, thiol groups, amine groups, hydroxyl, halo, cyano groups, sulfhydryl, carboxyl, and carbonyl groups, carbohydrate groups, vicinal diols, thioethers, 2-aminoalcohols, 2-aminothiols, guanidinyl, imidazolyl and phenolic groups.

Claim 30 (currently amended): The method of claim 24 in which said organic material comprises peptides or antibodies conjugated to said particles and capable of selectively targeting specific markers of the object~~, wherein said marker comprises vascular endothelial growth factor, epidermal growth factor receptor, HER2/neu receptor, folate receptor, human milkfat protein, annexin 5, proliferating cellular nuclear antigen~~.

Claim 31 (original): The method of claim 6 in which said particles are coated with inorganic material.

Claim 32 (original): The method of claim 1 in which said wavelengths are in the visible and near infrared spectrum.

Claim 33 (canceled).

Claim 34 (currently amended): The method of claim 32 [[33]] in which ~~the particles comprise gold and~~ the wavelength for irradiation is from about 520 nanometers to about 1120 nanometers.

Claim 35 (currently amended): The method of claim 34 in which the nanoparticulates comprise ~~most probable aspect ratio of said~~ mixed collections of gold and silver nanoparticles ~~is at least 2.0~~.

Claim 36 (currently amended): The method of claim 35 in which said nanoparticles ~~comprise gold and~~ have a ~~bimodal~~ multimodal distribution of aspect ratios.

Claim 37 (currently amended): The method of claim 36 in which one local maximum in the distribution of aspect ratios is about 4 and ~~the~~ another local maximum in the distribution of aspect rations is about 8.

Claim 38 (currently amended): The method of claim 37 in which said electromagnetic radiation comprises two or more wavelength bands ~~spreads~~.

Claim 39 (currently amended): The method of claim 38 in which one wavelength band is from about ~~690~~ 520 nanometers to about 800 nanometers and another wavelength band is from about 800 nanometers to about ~~1150~~ 1120 nanometers.

Claim 40 (original): The method of claim 1 in which said wavelength of electromagnetic radiation is chosen to match the maximum of absorption for particles at least partially coated with organic or inorganic dielectric material.

Claim 41 (original): The method of claim 1 in which said optoacoustic signal is produced through plasmon derived resonance absorption by conductive electrons in said at least one nanoparticulate.

Claim 42 (original): The method of claim 41 in which the electromagnetic radiation is pulsed and emitted from a pulsing laser.

Claim 43 (original): The method of claim 41 in which the electromagnetic radiation is a modulated continuous wave.

Claim 44 (original): The method of claim 1 in which said body is in an animate human or non-human body.

Claim 45 (original): The method of claim 1 in which said body is an in vitro specimen.

Claim 46 (original): The method of claim 1 in which said object is biological.

Claim 47 (currently amended): The method of claim 1 ~~52~~ in which said object comprises a specific tissue, cell, microorganism or molecule or distributions thereof.

Claim 48 (original): The method of claim 1 in which said step of introducing comprises administering said agent to accumulate in a specific tissue, cell or microorganism.

Claim 49 (original): The method of claim 1 in which said object is at least one tumor in an animate human or non-human body.

Claim 50 (original): The method of claim 1 in which said object is at least one virus.

Claim 51 (original): The method of claim 1 in which said object is at least one bacterium.

Claim 52 (original): The method of claim 1 in which said object is a physiologically operative molecule comprising glucose, an enzyme, a protein receptor, or a nucleic acid.

Claim 53 (original): The method of claim 1 further comprising generating a two-dimensional or three dimensional image from said detected signal.

Claim 54 (currently amended): A method of generating an image of an animate human or non-human animal body or part thereof, comprising:

(a) administering to said body a physiologically tolerable contrast agent comprising a collection of at least partially metallic nanoparticulates ~~particles~~ having a most probable size no smaller than about 1 nanometers and no larger than about 1000 nanometers and a formed non-spherical shape capable of absorbing specific selected wavelengths of electromagnetic radiation,

(b) exposing said body or part thereof to electromagnetic radiation in the near-infrared range of wavelength spectrum having a selected wavelength or range of wavelengths larger by a factor of at least 3 [[5]] relative to the minimal size of said particles,

(c) detecting an optoacoustic signal generated in said body as a result of heating said collection of at least partially metallic particles, and

(d) ~~(c)~~ generating an image from said detected signal.

Claim 55 (currently amended): The method of claim 54 [[59]] in which the conversion of said optoacoustic signal into said electronic signal is made through a detector selected from thermal, acoustic, optical or infrared detectors or a combination of such detectors.

Claim 56 (currently amended): A method of non-invasively detecting and treating ~~a tumor~~ a specific object of an animate human or non-human animal body or part thereof, comprising:

(a) administering to said body or a part thereof in a manner to position where presence of the object, including a tumor or abnormal cells, is to be examined a physiologically tolerable contrast agent

comprising a collection of at least partially metallic non-spherical nanoparticulates ~~particles~~ having a most probable size no smaller than about 1 nanometers and no larger than about 1000 nanometers and a formed shape capable of absorbing specific selected wavelengths of electromagnetic radiation,

(b) exposing said body or part thereof to electromagnetic radiation in the near-infrared range of wavelength spectrum having a selected wavelength or range of wavelengths larger by a factor of at least 3 [[5]] relative to the minimal size of said nanoparticulates ~~particles~~,

(c) detecting a optoacoustic signal generated in said body as a result of heating said collection of at least partially metallic nanoparticulates ~~particles~~,

(d) converting said optoacoustic signal into an electronic signal characterized by at least one parameter selected from amplitude, frequency, phase, temporal profile, time of arrival or frequency spectrum or a combination thereof,

(e) presenting said signal for assessment of said at least one parameter by a human or a machine for whether said object [[a]] ~~tumor~~ is present in said body, and

(f) directing onto said nanoparticulates ~~particles~~ a selected wavelength or range of wavelengths minimally absorbed by material of the body in order to heat said nanoparticulates ~~particles~~ at said object and produce enhanced optoacoustic effect sufficient to destroy viability of said object.

Claim 57 (new); The method of claim 13 in which said organic material comprises nucleosides, nucleotides, nucleotide acid constructs, polynucleotides, amino acids, peptides, oligopeptides, polypeptides, proteins, antibodies or antibody fragments thereof.

Claim 58 (new): The method of claim 14 in which said form of carbon having metallic properties is a carbon nanotube.

Claim 59 (new): The method of claim 47 in which said object comprises a bio-warfare agent.

Claim 60 (new): An optoacoustic imaging system for enhanced detection of a specific object in a body, comprising:

a source of electromagnetic radiation;

at least one acoustic transducer to detect optoacoustic signals generated upon absorption of the electromagnetic radiation;

means for electronically amplifying and displaying the detected signals as one-, two- or three-dimensional images; and

a collection of nanoparticulates disposable in proximate relationship to the specific object, said nanoparticulates having the following properties:

i. it is at least partially metallic,

ii. it has a formed non-spherical shape having a minimal characteristic dimension in the range from about 1 to about 3000 nanometers, and

iii. it has a formed composition capable of producing thermal pressure either in said nanoparticulate or in said object greater than said object could produce as a result of step (b) in the absence of said nanoparticulate; said optoacoustic imaging system adapted to perform method steps of:

a) directing onto said body specific electromagnetic radiation having a wavelength or spectrum of wavelengths in the range from 3 nm to 300 mm selected so that the wavelength or wavelength spectrum is longer by a factor of at least 3 than the minimum characteristic dimension of said nanoparticulate, said nanoparticulate absorbing said electromagnetic radiation more than would one or more non-aggregated spherically shaped particles of the same total volume with a composition identical to said nanoparticulate, said nanoparticulate by such absorption producing an enhanced optoacoustic signal resulting from said absorption;

(b) receiving said optoacoustic signal;

(c) converting said received optoacoustic signal into an electronic signal characterized by at least one parameter selected from amplitude, frequency, phase, temporal profile, time of arrival, frequency spectrum, or a combination of any one or more of such parameters; and

(d) displaying said signal for assessment of said at least one parameter by a human or a machine.